

Studentship Project: Annual Progress Report 10/2023 to 10/2024

Student Name:	Camila Gonzalez	AHDB Project Number:	SF/TF 170a
Project Title:	Understanding the control of continuous running and perpetual flowering in strawberry		
Lead Partner:	Berry Gardens		
Supervisor:	Prof. Timo Hytönen		
Start Date:	20/10/2021	End Date:	19/09/2025

1. Project aims and objectives

Due to year-round consumer demand for strawberries and the rising costs of transporting imported fruit, extending the cultivated strawberry cropping season has become a key focus of strawberry breeding programs worldwide. Selective breeding for everbearing cultivars can lead to new varieties that produce fruit throughout the growing season, and further extending the season could be achieved through the manipulation of flowering time. However, the genetic mechanisms controlling perpetual flowering and running in cultivated strawberries are not yet fully understood, which limits their potential for use in marker-assisted breeding and genome editing.

Additionally, there is a significant trade-off between flowering and running, so a deeper understanding of the genetic control of running could help breeders select cultivars with continuous running phenotypes. By elucidating these genetic mechanisms in cultivated and wild strawberries, it will be possible to identify novel target genes and develop genetic markers to enhance breeding strategies. Therefore, the goal of this project is to dissect the control of perpetual flowering and running in strawberries using genetic mapping and genome editing. The project is divided into three main work packages:

Work Package 1 (WP1): Understanding the regulation of *TFL1* and *FT1* in *F. x ananassa*. This package focuses on unravelling the control of perpetual flowering in cultivated strawberries.

Work Package 2 (WP2): Identifying candidate gene(s) in the pathway controlling the timing of vegetative reproduction in strawberries. WP2 involves identifying the candidate genes responsible for the transition between flowering and running in the ES12xICE12 population through genetic mapping.

Work Package 3 (WP3): Functional analysis of candidate gene(s) controlling the timing of vegetative reproduction in strawberries. WP3 aims to validate the role of the candidate gene(s) identified in WP2 in regulating running and ensuring the continuous running trait in the population.

The results described in this summary report are interim and relate to one year. In all cases, the reports refer to projects that extend over a number of years.

While the Agriculture and Horticulture Development Board seeks to ensure that the information contained within this document is accurate at the time of printing, no warranty is given in respect thereof and, to the maximum extent permitted by law, the Agriculture and Horticulture Development Board accepts no liability for loss, damage or injury howsoever caused (including that caused by negligence) or suffered directly or indirectly in relation to information and opinions contained in or omitted from this document. Reference herein to trade names and proprietary products without stating that they are protected does not imply that they may be regarded as unprotected and thus free for general use. No endorsement of named products is intended, nor is any criticism implied of other alternative, but unnamed, products.

2. Key messages emerging from the project

- Understanding the regulation of key flowering genes in the cultivated strawberry will aid the use of advance breeding/ genome editing strategies for crop improvement
- The identification of the locus and candidate genes that control the continuous running trait in strawberry will contribute to future breeding efforts

3. Summary of results from the reporting year

WP1

- Confirmed transformed plants (first and second generation)
- Weaned selected plants
- Finished phenotyping of the first generation of selected plants

WP2

- Prepared plants for phenotyping experiment under short day conditions

WP3

- Transformed FIN56 explants and regenerated several shoots

4. Key issues to be addressed in the next year

- Difficulties with confirming genome edited plants
- Ensure with the glasshouse team that the environmental (experimental) conditions are accurately maintained

5. Outputs relating to the project

(events, press articles, conference posters or presentations, scientific papers):

Output	Detail
Online project presentation for the Crop Science Seminars at the University of Reading (2021, 2022, 2023, 2024)	Project presentation for the Crop Science community at the University of Reading
University of Reading Crop Science symposium (2021, 2022, 2023, 2024)	Project presentation for the Crop Science symposium at the University of Reading
Presentation for the Genetic, Genomics and Breeding symposium at NIAB, East Malling (2022)	Project presentation for the GGB department symposium at NIAB East Malling
CTP events (2021, 2022, 2023, 2024)	Project presentation at the CTP events
Interview for the ITVX TV series called	Interview about my career in science and about my project

"Generation Genome' (2023)	
FAR conference (2023)	Short talk at the Future Agricultural Researchers PhD Conference 2023 in Exeter

6. Partners (if applicable)

Scientific partners	Prof. Dan Sargent, Dr. Matt Ordridge
Industry partners	Harriet Duncalfe
Government sponsor	CTP (BBSRC-UKRI)